

## ANSWER TO EDITOR

Thank you for the submission of your manuscript “A regional scale approach to assess non-residential buildings, transportation and croplands exposure in Central Asia”.

As you know, two reviewers have provided detailed reviews, which you have replied to. Reviewers’ recommendations are very different. Referee #1 recommended minor revisions, whereas Referee #2 reported several critical issues in the manuscript and suggested major revisions.

In particular, Referee #2 raised various critical issues about:

- the limited replicability and transfer of the main findings of your study to a broader context, due to the specific features of the investigated case studies;
- the lack of an in-depth review of exposure databases available in literature, independently from the Central Asian context;
- the lack of comparison with similar studies (e.g. different approaches and assumptions adopted for building up exposure databases).

Based on the reviewers’ comments and your replies, I would like to invite you to submit an in-depth revision of your manuscript, with substantial improvements mainly in relation to the above-mentioned issues. Please also provide an ‘author’s reply’ to the reviewers and include, in the same author reply document, a track changes document between the old manuscript and the new one.

I look forward to receiving the next version of your manuscript.

*Dear Dr. Bonaccorso, thank you for your comments. We carefully reviewed the manuscript and responded to the issues raised by Reviewer 2, in particular by rewriting the introduction. We included a literature review that goes beyond the study area and highlights the main open challenges in developing exposure datasets of critical infrastructure. We also underline the novel aspects of our methods, compare it with similar studies and discuss its potential for being applied in other study areas. Please find attached my responses to the reviewers (in blue), together with the manuscript and its version in tracking change mode. The line numbers refer to the manuscript with the tracking changes.*

## ANSWER TO REVIEWER 1:

*This reviewer endorses the article for publication with very minor revisions: please add the latitude/longitude grid in the figures, other than the scale bar.*

*Thank you for your comment. We’ve refactored the figures adding the latitude-longitude grid.*

## ANSWER TO REVIEWER 2:

*This paper builds a regional exposure database for several types of critical infrastructure in Central Asia, including industrial, commercial buildings, education and healthcare infrastructure, as well as transportation networks (roads and railways) and crops. The dataset is transboundary as it covers the five central Asian countries that were formerly part of the USSR, and is meant to assess damage to several hazard types including flooding, earthquakes, droughts, etc. This database uses a variety of data sources, several of which have to be spatially disaggregated using assumptions that are reasonable and clearly laid out.*

*The writing is clear, the presentation and technical work within are high-quality. Aside from a few minor queries regarding data access and presentation (see below), the major obstacle to publication is a lack of explanation on scientific context and literature aside from the central Asia context. The developed database is multi-hazard, multi-asset, and transboundary: how does that compare with existing databases, e.g., developed for other places? In other words: is the paper just a case-study whose experience is disconnected from that of building multi-layer exposure databases in other regions? Authors should bear in mind the journal’s Aims & Scope, which does “not encourage” “localised case studies with no broader implications (in other words, ask yourself, what would someone else in another region learn from the case study that you have done; what is the broader context?).”*

*Thank you for your suggestions. We agree with the reviewer that the manuscript in its current form does not highlight the broader implications of the work and is very focused on the Central Asia context.*

*The work presented here provides useful insights on how to develop exposure layers at the regional scale based on the combination of both regional-scale data and information at the country level. We focus our analysis on selected critical infrastructures and exposed assets: healthcare facilities, schools, commercial and industrial buildings, transportation network and agricultural system. For critical infrastructures, at the time of the analysis, no publicly-available exposure layers of critical infrastructure to multiple hazards existed for Central Asia. Exposure layers for selected assets were developed in some countries (e.g. Kyrgyz Republic) and for selected infrastructure (e.g. transportation) during past projects which are acknowledged in the manuscript. Developing a regional-scale exposure model for the selected assets was nonetheless required as a first step towards an assessment of potential consequences of floods, earthquakes and landslides that go beyond national boundaries. We collected data from different countries and communities and*

structure them within a regional-scale database, for which we interacted with a wide range of project partners and stakeholders. The exposure dataset was developed on a considerably high resolution (100m) which supports the assessment of risk related to floods, for which a much higher resolution in order to provide reliable results with respect to earthquakes. Gathering data on critical infrastructure is a known challenge, and we include references on the state of the art, underlining how we interacted with stakeholders, what kind of data was collected and how it was used. We also discussed the caveats of the methods and its potential application to other study areas and/or future work for enhancing it. These aspects were highlighted in the text, also by broadening the context and the state of the art, in order to clarify the novelty of the work and its validity also for other contexts.

We re-wrote the entire introduction and substantially modified the discussion to address this and provide a broader context to the reader. The introduction, discussion and conclusions have been rewritten accounting for your suggestions as explained in the following sections. The line numbers refer to the manuscript annotated with tracking changes.

For the paper to fit the journals Aims & Scope, authors need to rethink (and largely rewrite) three sections:

- **Introduction:** authors should review literature on making exposure layers for several types of critical infrastructure: what is considered together and for what reasons? How is their database more comprehensive? Or what obstacles does it overcome that other multi-layer database of critical infrastructure didn't have to deal with? Note this is more than just adding a paragraph to pay lip service to what exists: authors need to review exposure databases for the different layers, the multi-layer efforts, and actively situate this work within this literature, independently from the Central Asian context.

The introduction was completely rewritten (lines 39-81) including a review of the current methods to develop exposure assessment of critical infrastructure and pointing out the main challenges (lines 44 to 70). We also include a broader justification of why our dataset is addressing these challenges by including spatial and non-spatial data from multiple country-based sources and considering assets exposed to different hazards (lines 71-81).

All the information related to the regional context (description of the Central Asia region and hazard and exposure characteristics) was moved to a dedicated section. A figure for the study areas was also added (lines 82-144 and fig. 1).

- **Discussion:** it is nice to see authors discuss some of their assumptions there. But these are learning points for other researchers that would want to put together similar databases somewhere else, and for these reasons, the discussion should explain how similar or different the authors' assumptions were from what is done for other exposure databases (and what are reasons that motivated different approaches). In other words: authors need to confront each point they make with the existing literature.

The discussion was enhanced by including references to the state of the art and explaining how this work collects existing approaches and/or differs from them. In particular, we underline why this approach is novel and what is its potential for being adopted in other contexts (lines 442-452). We also compare our assumptions to those of similar works done by other authors (lines 455-473). We also describe the potential of the high-resolution dataset to support flood risk assessment (lines 474-480). We also give emphasis to the use of an existing taxonomy, the GED4ALL, and its advantages and disadvantages for multi- and cross-hazard analyses (lines 446-447 and 509-511). Finally, we point out future work to be done to further enhance the exposure layers also thanks to citizens (lines 517-519). All these aspects are integrated into the discussion so that the reader can understand which are the strengths of the method, the assumptions taken, the novel aspects and the limitations to be fulfilled in future work.

- **Conclusions** should summarise in a few sentences what the paper adds to the broader literature.

Conclusions were modified to highlight our contribution and the impact of the work for disaster risk reduction purposes. In particular, we highlighted the fact that we engaged local partners to collect country-based data including reconstruction costs, and that we produce multi-hazard exposure datasets using a standardized taxonomy (lines 524-529).

After that, it could be relevant to spend a bit of time to see whether the new information added to the paper could improve the abstract.

The additional information collected during the review and integrated into the manuscript has been included in the abstract. In particular, we underline the current gaps and challenges in exposure assessment of critical infrastructure and emphasize our contribution in tackling them ((lines 19-20 and 24-26)

A few queries on data presentation / availability / access:

Section 2 text should comment on Table 1 in greater detail. This is true in particular for national and sub-national data. Personal communication sources (institution or public servants) should be mentioned, because local partners must be credited; alternatively, a clear explanation should be provided as to why they cannot be named. The number of oblasts per country should be given to give a better idea of the granularity of the data.

Thank you for the comment. We enhanced the data collection section by adding information on how data collection was performed (lines 166-174). The data collection was indeed a pivotal part in the project. Additional challenges were put by the COVID-19 pandemic that negatively conditioned the interactions, with only virtual meetings and no possibility

to interact in person. The local research groups, for which the representatives are co-authoring the manuscript, were in charge of gathering reliable information at the country level. They provided it through official documents and/or information from various sources, sometimes collated into personal communications. Dedicated online meetings were periodically organized for each country to discuss specific issues and data requirements, and data were collected through shared folders and tables where each group of partners could contribute. The process was also supported by country-based workshops that provided participants with an overview of the exposure assessment methods to be applied. The process of assembling an exposure development layer was carried out for selected case-study and using data provided from local partners. This facilitated both data collection and the demonstration of the approaches in a context familiar for participants, More details are provided by Peresan et al. (2023). We included more detail on the data provided and the process of data collection. We modified table 1 including the institutions or the persons who provided the information. We also added the number of Oblasts per country to the table.

*In Table 1, what is missing is a year tag for each data source.*

*We included a year tag to the data sources in Table 1. The year is relative to the last known update of the referenced dataset, as explained in the new table caption.*

*On a related note, it would be good to provide a map of the region including the countries and their names.*

*A map was added showing the Central Asia Region and including each country name (Fig. 1).*

*Data availability: is there no way to make the resulting dataset available along with the publication of the paper (rather than to wait for publication by the World Bank)? As things stand, the paper discusses an unpublished database...*

*At the time of the submission, the datasets were in the process of being published. They are now available (since 01/09/2023) under the Creative Commons Attributions 4.0 license at the following link: <https://datacatalog.worldbank.org/search/dataset/0064117/Central-Asia-Exposure-Data>. The links to the databases and the official project reports were included to the Data availability section.*